A PROPOSED ADDRESS RECOGNITION SYSTEM FOR DESTROYER MESSAGE COMMUNICATIONS

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THESIS

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ABSTRACT

An address recognition system is proposed for use on destroyers and other small ships. This proposed system is designed to be completely compatible with current fleet broadcast teletype communications methods and uses components, subsystems, and devices readily available off-the-shelf. The address recognition system is designed to search the fleet broadcast for messages addressed to own ship or unit. Only those messages addressed to own ship or embarked commands are printed out in the ship's communications center. A complete broadcast record is available if needed.

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I. BACKGROUND

Since World War I the Naval Communications System has utilized the fleet broadcast method of delivering message traffic to ships and commands embarked in ships. By this method, a specific ship or unit copies a specific broadcast in the area of the world in which it is operating. By means of the ship's movement report, the entire Naval Communications System is kept informed of which broadcast each ship is copying. Commands in any part of the world having message traffic for a ship may then enter that traffic into the Naval Communications System at any location in the world and be assured that it will be delivered to the proper station and will be transmitted over the appropriate fleet broadcast. The system works very well and indeed, for mobile units it is probably the only feasible system for providing reliable, secure and speedy communications.

Originally, fleet broadcasts used continuous wave (CW) modulation and were limited to speeds of no more than about thirty words per minute due to the shipboard operator's inability to copy significantly faster transmission rates. Subsequent to World War II the use of teletype transmission on the fleet broadcasts was begun. When this method of transmission was fully implemented, speeds of sixty words per minute were used.

In the early 1960's the teletype transmission rate was increased to one hundred words per minute in an effort to better handle the constantly increasing volume of message traffic being addressed to the operating fleets. Recently, fleet broadcasts have been transmitting approximately thirty thousand messages per month.

Reliability is the foremost watchword in Naval communications. In order to ensure that each ship has all message traffic addressed to it, each fleet unit is required to have a complete file of all messages transmitted on the fleet broadcast it is copying. These files must be retained for a specified period of time--usually three months. It is necessary that each ship, therefore, receive and account for each broadcast message. Broadcast messages are serially numbered starting afresh the first of each month in order to facilitate accounting and to ensure that each ship has a complete file.

A. PROCEDURE

Each message which comes aboard a ship via the fleet broadcast must have its heading checked to see if it is addressed to that ship or unit. Each ship maintains a guard list which is a list comprising all of the addresses which may be used to send a message to that unit. For a destroyer, this may include, but is not necessarily limited to the following:

Own ship name	Task Force
Squadron	Task Group
Division	Task Unit
Flotilla	Task Element
Type Command	Special Force
Numbered Fleet	Address Indicating Groups (AIG'S)
General Messages (e.g.	ALCOM, ALCOMLANT, ALLANTFLT, ALNAV, NAVACT, NAVOP, ALMILACT, etc.)

As can be seen, there can be upwards of two dozen different names by which a ship can be addressed. The heading of each and every message transmitted over the fleet broadcast must be checked by each unit against this rather large list of addresses. To ensure against missing a message addressed to it, each ship normally at least double checks and not infrequently triple checks all of the received messages, each check being performed by a different person.

If the message is addressed to that ship or unit, it is processed for internal distribution to cognizant personnel aboard the ship. If it is not addressed to that ship or unit, no further action is normally taken.

It is not difficult to realize that there is a tremendous amount of work involved in the process of checking messages aboard ship. Particularly on ships of destroyer size and smaller, where there may be no more than ten to fifteen personnel to man the entire radio installation, the workload becomes extremely high.

It is not difficult to imagine either that something approximating one percent of the received messages may actually be addressed to any given ship or unit. This means

that a great deal of man hours are expended checking and rechecking messages which are not addressed to own ship.

The teletype equipment used in printing out the messages aboard ship is a page printer unit. All teletype equipment is electromechanical in nature with the accent very heavily on the mechanical side. Such equipment is subject to friction wear and requires continuous lubrication and adjustment to keep it operating. This is a further workload on the communications personnel and requires the maintenance of trained and qualified teletype repairmen on board to constantly maintain the equipment.

II. GENERAL

In view of the above it can be easily seen that a device which would monitor the fleet broadcast and select the messages addressed to own ship would go a long way towards lightening the workload on the destroyer communications personnel and would also save a great deal of wear and tear on the teletype equipment. This paper proposes a design for such a device.

An address recognition system would have to be capable of checking the heading on each message received via the fleet broadcast. It should allow those messages which are addressed to own ship to pass on for internal processing and distribution aboard ship. It should block those messages which are not addressed to own ship.

A system to perform this function has been designed and put together by the Naval Electronic Laboratory Center in San Diego for the USS OKLAHOMA CITY (CLG-5). It is called the Message Processing and Distribution System for USS OKLAHOMA CITY (CLG-5), (MPDS/CLG-5 for short). It is a computer centered system, and as its name implies, not only is capable of sorting out those messages which are addressed to the ship and its embarked staff, but also controls internal distribution to a large extent. Messages are entered off-line via paper tape and the system takes over from there, providing voluminous long term storage as

well as short term, almost instantaneously recallable, storage for approximately five thousand messages. While this system does a fine job for the type ship for which it was designed, it is totally unsuited to a destroyer or smaller ship. It takes up a great deal of space which is not available on a destroyer, and requires operation and maintenance personnel which could be neither justified nor berthed on the average destroyer. It does many jobs which the traffic load for a destroyer plus an embarked staff do not require.

A. TELETYPE COMMUNICATIONS

Some background on teletype communications procedures is necessary in order to understand how such a device would have to work.

The code used for teletype transmission is a start-stop signaling code in which each character or function is represented by a sequential combination of current and no-current time intervals. Intervals during which current flows in the circuit are referred to as marking intervals or marks. Intervals during which no current flows in the circuit are called spacing intervals or spaces. Each combination of pulses representing a character or function includes five information carrying pulses. To ensure synchronization between the transmitting and receiving stations, a start pulse (space) is added at the beginning of each combination and a stop pulse (mark) is added at the

end. The stop pulse may either be of the same duration as the other pulses, or it may be longer--either one and one-half times as long or twice as long. Therefore either a seven unit code, a seven and one-half unit code, or an eight unit code may be used. The code is illustrated in Figures 1 and 2.

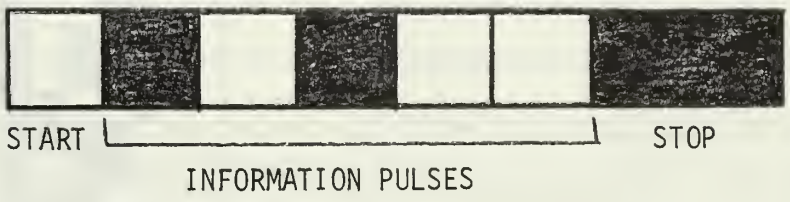


Figure 1. Teletype Code

The maximum speed of current teletype operation is one hundred words per minute. This gives approximately six hundred characters or functions per minute or about one hundred milliseconds each if a seven and one-half unit code is used. This is slow speed by today's electronic standards.

Currently addresses used on teletype messages are plain language short title addresses, such as USS SOLEY, DESRON TWO, CRUDESLANT. These addresses may vary widely in length, especially when ships names are concerned. An address recognition system for these varying length addresses is difficult to construct simply and compactly.

Current message formats use the prosign BT (meaning BREAK) in two locations. It is used to separate the heading

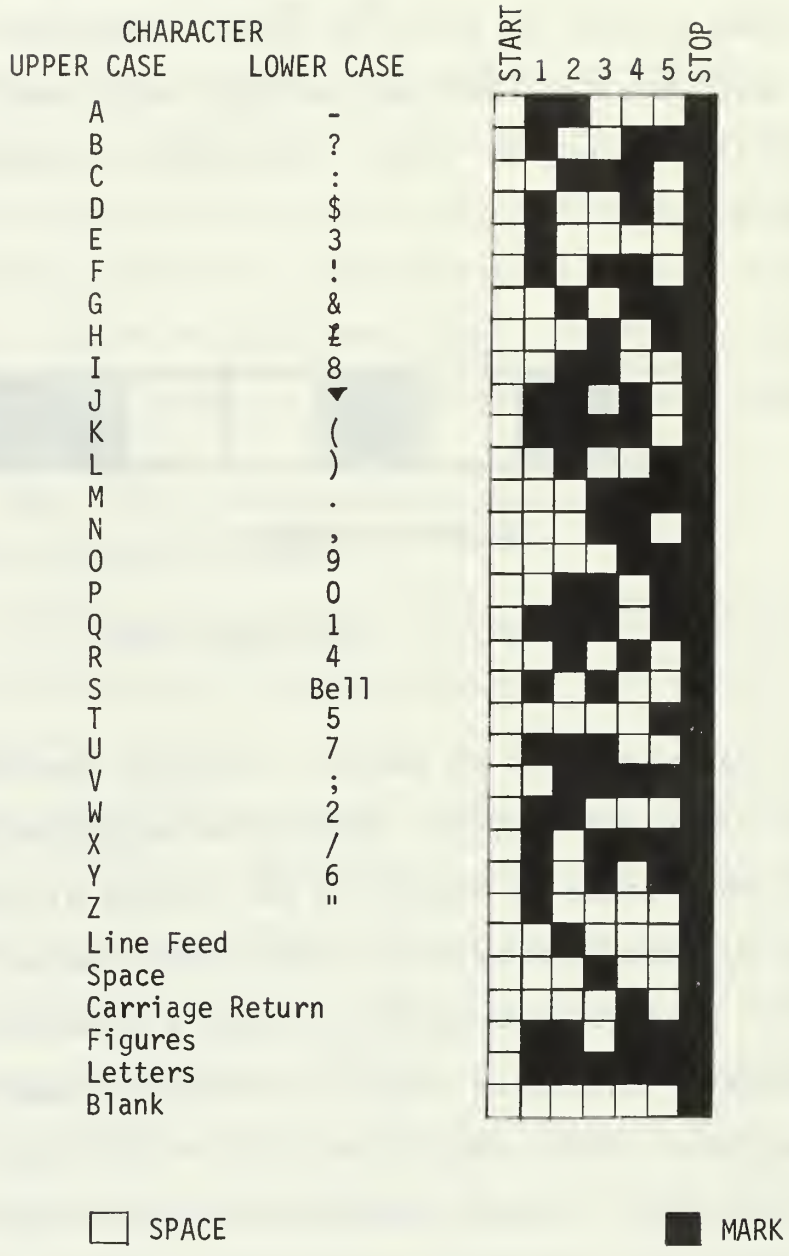


Figure 2. Teletype Signaling Code

of a message from the body or text of the message and also to indicate the end of the message text. (See Figure 3.)

1. Recommended Changes

For the design of the address recognition system proposed here it is recommended that changes be made in both of these message format procedures.

The current editions of two confidential Allied Communications Publications, ACP 113 ( ) Call Sign Book for Ships, and ACP 100 U. S. Supplement No. 1 ( ) U. S. Call Sign and Address Group System-Instructions and Assignments, provide call sign assignments for all conceivable addresses by which an operating fleet unit might be called. These call signs consist of groups of four alpha-numeric characters and have been assigned to all ships, task organizations, administrative organizations, address indicating groups, general messages, etc. Prior to the general use of teletype in the early 1960's, CW communications were used on many circuits. In CW communications the four letter call signs were used exclusively. It is only since the teletype became the normal means of communications that plain language calls have come into general use. Four letter call signs are still used a great deal in visual signaling. A return to the use of these assigned four letter calls is proposed here to facilitate the design of a simple address recognition system.

P 031535Z

FROM COMCRUDESLANT
TO USS SOLEY
DESRON TWO
AIG 415
INFO CRUDESLANT
DNC

BT
UNCLAS
NAVAL COMMUNICATIONS
CNO 020545Z

IT HAS BECOME INCREASINGLY APPARENT THAT MODERN MANAGEMENT AND ENGINEERING TECHNIQUES MUST BE EMPLOYED IN NAVAL COMMUNICATIONS TO ENSURE THAT THE SYSTEM IS CAPABLE OF HANDLING THE EVER MOUNTING VOLUMES OF MESSAGE TRAFFIC WITHOUT SACRIFICING ANY OF THE ELEMENTS OF RELIABILITY, RAPIDITY, AND SECURITY.

BT

Figure 3. Typical Naval Teletype Message

The use of the prosign BT to end both the heading and the message text is a source of confusion in the design of automatic equipment. It is interesting to note that this prosign used in two places in a message was a design problem with the MPDS/CLG-5. It is proposed that two new prosigns be used and that their use be only for teletype procedures. This would avoid changes to visual and radiotelephony procedures. These new prosigns should be BTH to signify the end of the heading and BTM to signify the end of the message text.

2. Transmission

Teletype mark and space signals are normally transmitted as shifts of a radio frequency carrier above and below a center frequency. Navy standard communications receivers (RBA, RBB, RBC, R-390/URR, SRR-11, -12, -13, etc.) receive and translate these frequency-shift-keyed (FSK) signals into frequency variations above and below a center frequency of either 1000 Hz. or 2550 Hz. A Comparator-Converter Group such as the AN/URA-17 or the AN/URA-8 changes these frequency shifted audio signals into direct current mark-space pulses for operation of the loop-keying circuit of a teletype printer or tape perforator. A diagram of the system is shown in Figure 4.

In order to achieve the advantages of the address recognition system and yet not lose the ability to have the entire broadcast if required or desired, it is proposed that

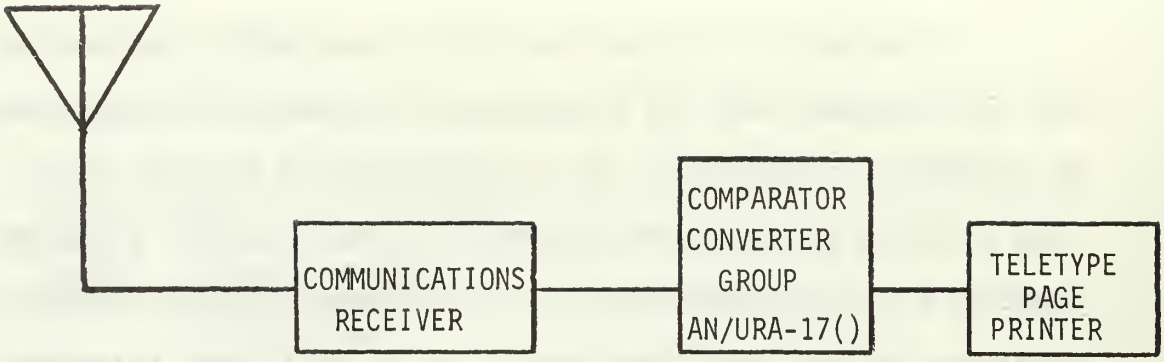


Figure 4. Normal Teletype Reception System

the system shown in Figure 5 be used aboard destroyer type ships for teletype fleet broadcast reception.

An audio tape recorder such as the AN/UNQ-7( ) is used to record the audio signals at the output of the receiver. This recorder should operate at a speed of 1 7/8 inches per second in order to conserve tape. Sufficient frequency range is available at this tape speed for a good signal to be recorded. This practice would provide the ship with a record of the entire broadcast for its files. It would also allow replay of this broadcast through the converter (CV-483/URA-17) of the AN/URA-17 to a teletype page printer should there be any question of message content or address.

In normal operation the output of the Comparator-Converter Group AN/URA-17 is examined by the address recognition system. If this system detects one of the call signs by which the ship or unit may be addressed, it allows

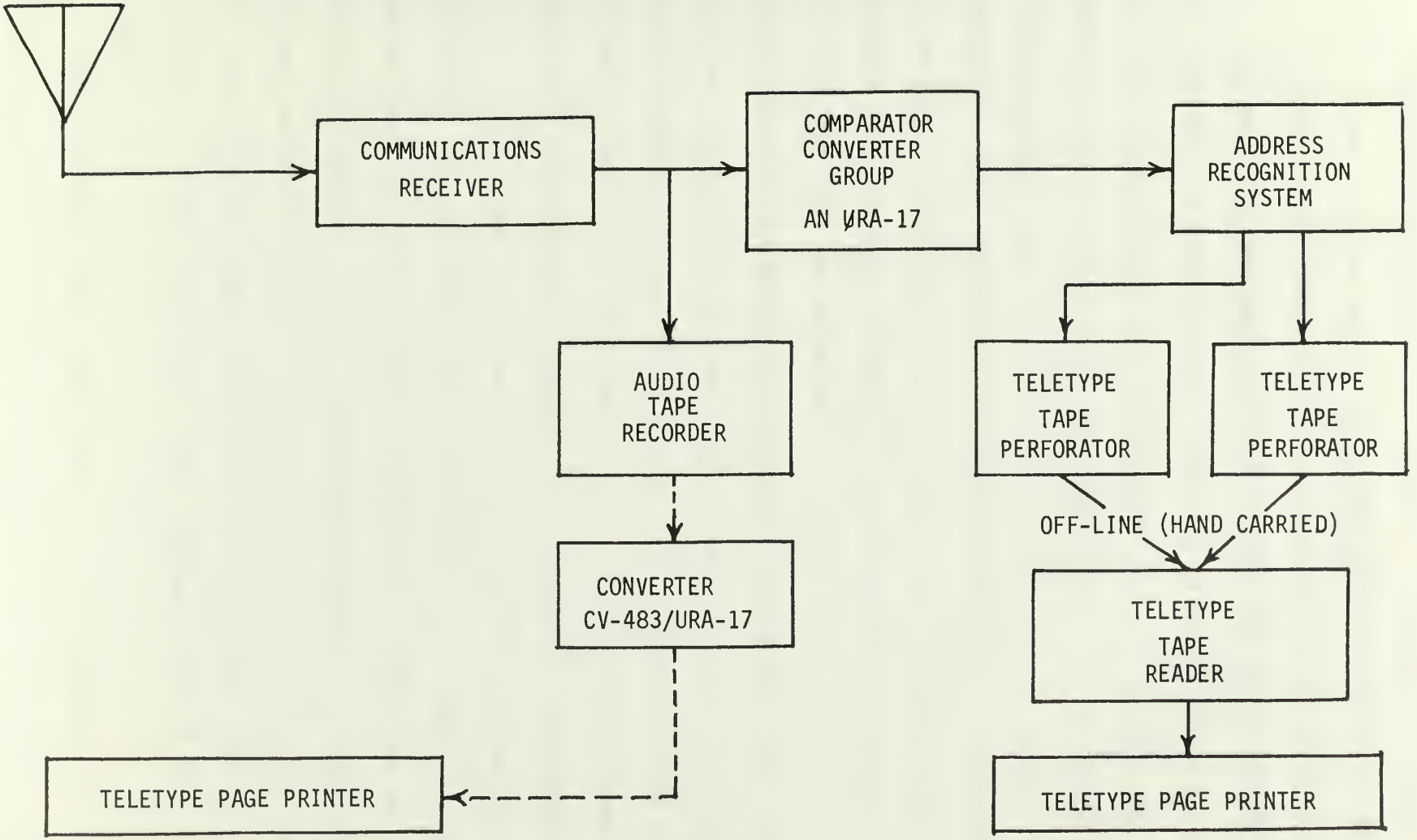


Figure 5. Proposed Teletype Reception System

the signal to pass on through to the tape perforators. If the message is not addressed to own ship or unit, it is not passed by the address recognition system and is not outputed in any form except on the magnetic tape.

III. CONSTRAINTS

The address recognition system must be able to search the heading of each message received via the fleet broadcast and determine from the heading whether or not the message should be outputed in hard form, i.e. on paper tape. Since messages are transmitted serially on the fleet broadcast, the end of one message signifies the beginning of the next. Therefore the portion of the transmission between the receipt of BTM and the subsequent receipt of BTH is what must be examined. Further, the call signs which must be checked always follow the proword TO. The address recognition system, then, must search the broadcast transmission for the prosign BTM. Having found this, it must search for the proword TO. It must then check each call sign following TO against a previously supplied list. If the call sign is not on the list, no further action need be taken. If the call sign is on the list, however, then the message must be allowed to output in hard form on the tape perforators. If no call signs on the list have been recognized by the time the prosign BTH is received, then the system must cease searching until the next BTM is received. A flow chart for this system is shown in Figure 6.

The procedure described above has one problem as it stands and that is that the portion of the message heading

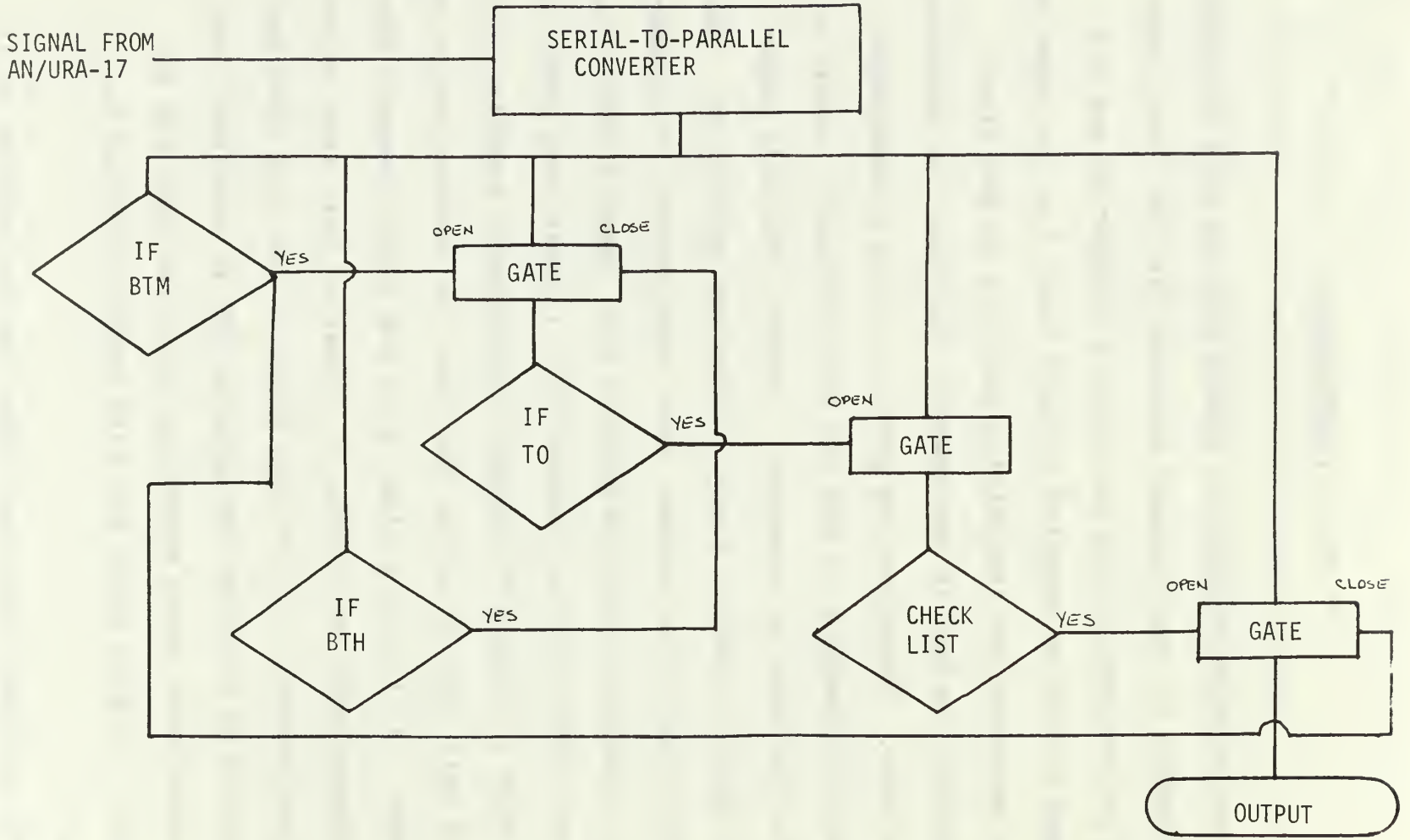


Figure 6. Address Recognition System Flow Chart

prior to own unit call sign is lost. In order to overcome this fault, a small tape recorder of the cartridge variety can be added to record the heading of each message received. This tape recorder would play the heading back into an output device if own unit call sign is located among the addressees. If own unit call sign is not among the addressees, it would do nothing. The flow chart for this operation is shown in Figure 7.

If the entire address recognition system is put together into a block diagram, it would look like Figure 8. Its method of operation is as follows: The system first searches the incoming message for the Prosign BTM which signifies the end of a message and the subsequent start of another. At this point it begins searching for the proword TO. When the proword TO is found, the address recognizer is put into operation and it searches the call signs in the address of the message comparing each one against the ship's guard list. If any of the address call signs in the message match the ship's guard list, the message is routed to the tape perforator and is produced in hard copy form. If no address is found on the message which matches those on the ship's guard list, the system keeps searching until the prosign BTH is received. At this point, the system ceases search and waits until the prosign BTM is again received to continue its search.

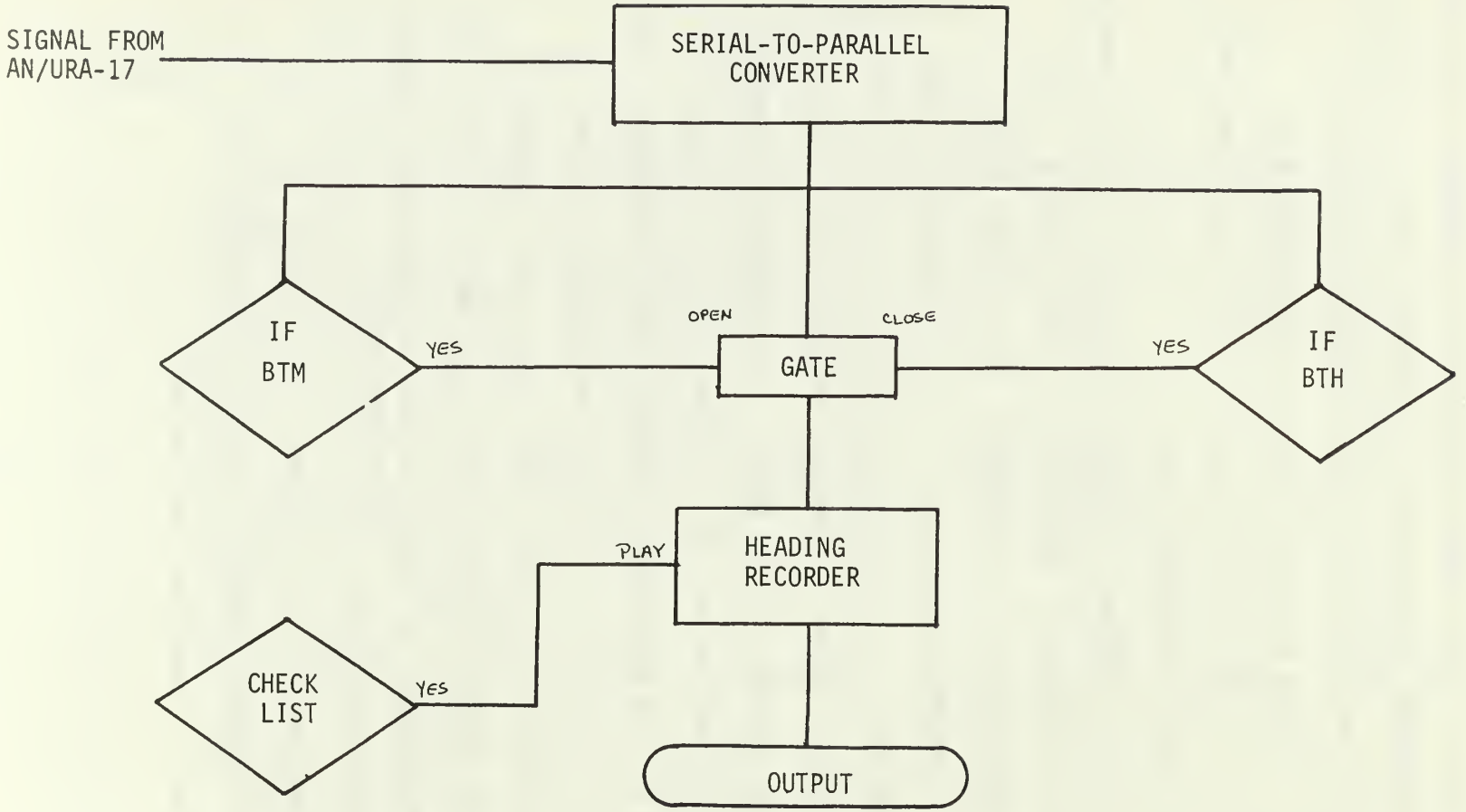


Figure 7. Previous Heading Recorder Flow Chart

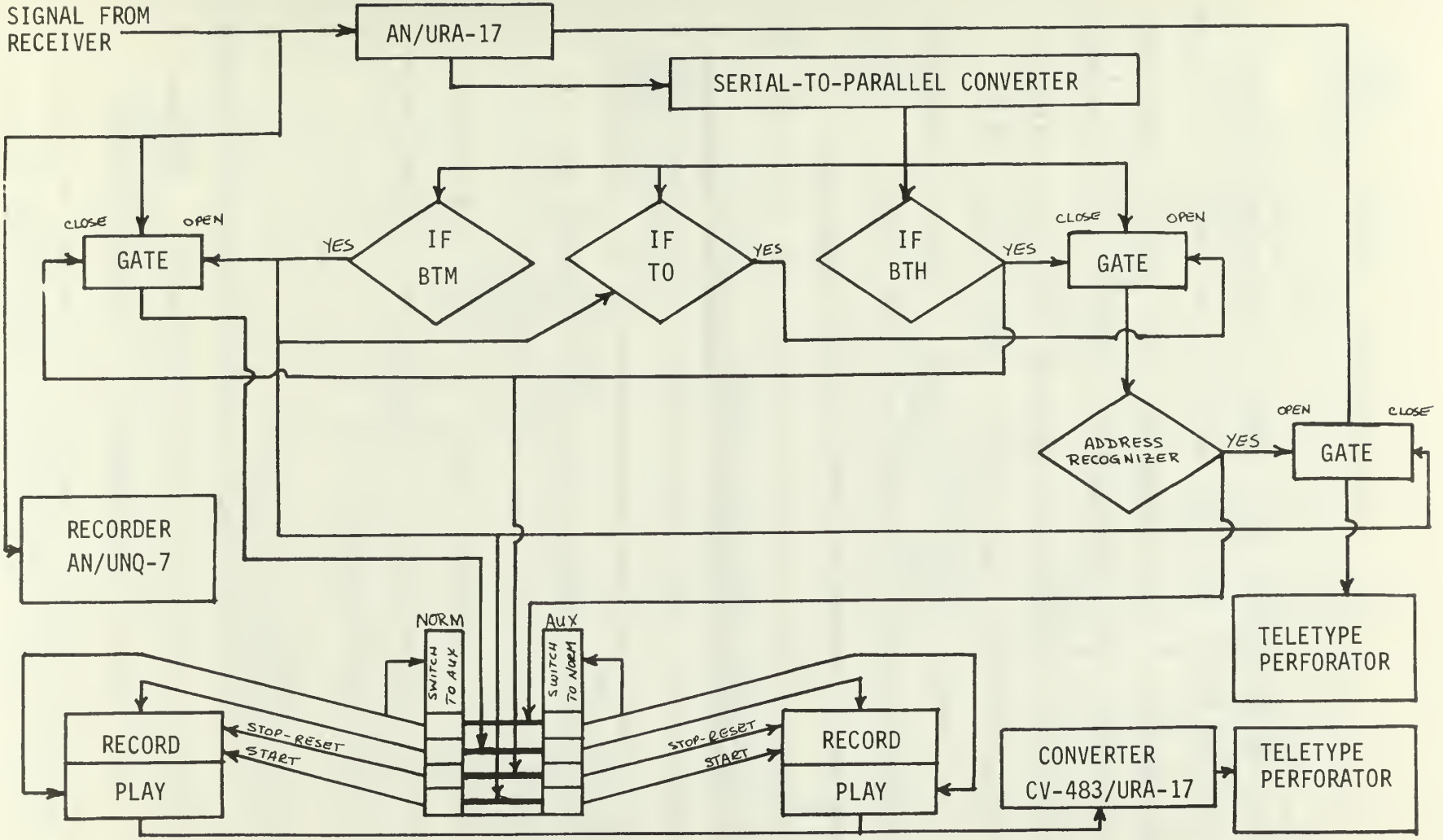


Figure 8. Address Recognition System Block Diagram

IV. SYSTEM DESIGN

Referring to Figures 6, 7, and 8, it can be seen that the system has three specific decision functions to perform that are the same for all ships and never vary. These are the recognition of the prosigns BTH and BTM and the proword TO. These three non-changing decision functions would be permanently wired into all systems. Each of them would operate on a serial recognition scheme. Figure 9 shows the BTM recognizer which is identical in block diagram to the BTH recognizer. Figure 10 shows the TO recognizer.

The other decision function which must be performed is to check the message addressees against the ship's or unit's guard list. This last decision function must vary from ship-to-ship and from time-to-time as the ship or unit changes operational command and thereby becomes part of other fleets, forces, and task organizations. It must be easily changeable by ship's force. It must be a serial recognition device similar to the permanently wired recognition devices discussed above.

A. CHARACTER RECOGNIZER

Basic to each of the serial recognition devices discussed is the ability to recognize a single character. As shown in Figure 8, the output of the Comparator-Converter Group AN/URA-17 is sent through a serial-to-parallel converter prior to being applied to any of the recognition devices.

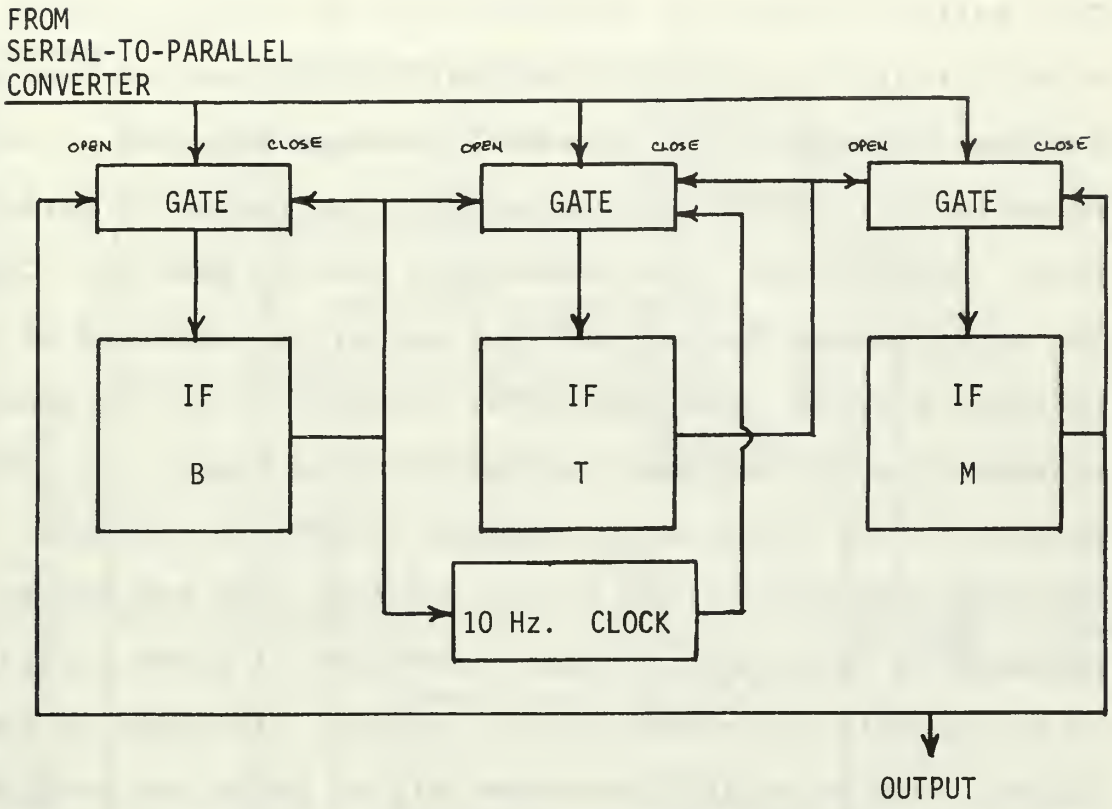


Figure 9. BTM/BTH Recognizer Block Diagram

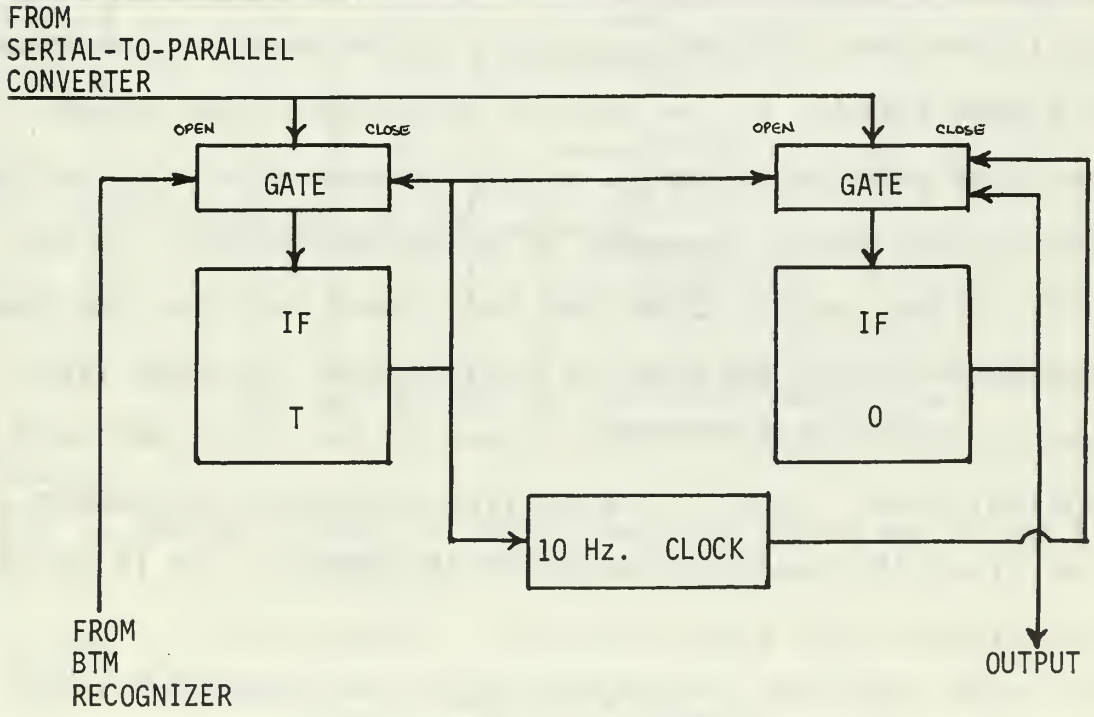
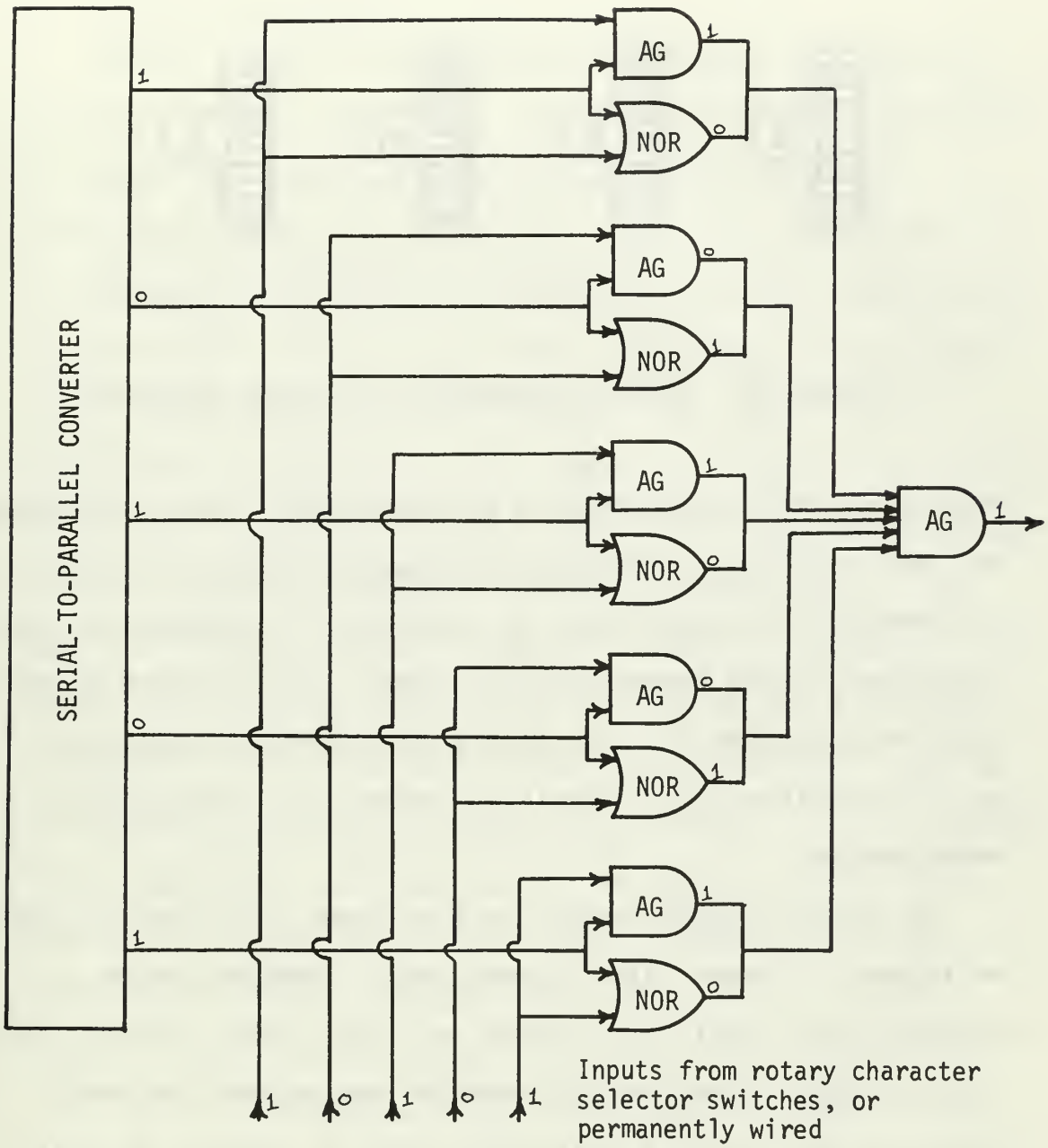


Figure 10. TO Recognizer Block Diagram

This serial-to-parallel conversion can be accomplished by a shift register or an off-the-shelf module such as Digital Equipment Corporation's Type W706 Teletype Receiver. (See Appendix A.) Incident to conversion from serial to parallel form, the start and stop pulses must also be removed. Once the asynchronous, serial teletype signal is converted to a parallel five bit code, character recognition can be accomplished by a circuit such as that shown in Figure 11. This circuit is the heart of the address recognition system. The five information bits of the teletype code are fed in parallel to five sets of gates. Each set of gates consists of an AND gate and a NOR gate in parallel, as shown in the figure. The other inputs to the sets of gates are provided via rotary selector switches of the type shown in Figure 12, or in the case of the permanently wired decision functions, are hard wired. In the case of call signs, the rotary switches provide a simple, easily changed system of telling the circuit which character is to be recognized. If and only if the logical code from the rotary switches (or the permanent wires) matches the logical code received from the AN/URA-17 will all five inputs to the final AND gate be logical ones. Thus if the desired character is present, the final AND gate will output a logical one and if it is not present, the output will be a logical zero.

Each time that a character must be recognized in the entire system, it is accomplished by a circuit such as that in Figure 11. This requires three such circuits to



AG — AND Gate--Output is logical 1 when all inputs are logical 1's. Output is logical 0 otherwise.

NOR — NOR Gate--Output is logical 1 when all inputs are logical 0's. Output is logical 0 otherwise.

Figure 11. Basic Character Recognizer Diagram

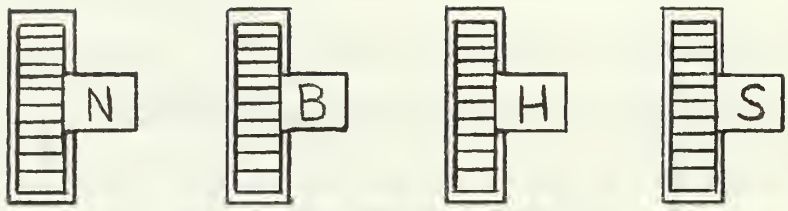


Figure 12. Rotary Thumbwheel Selector Switches

recognize BTM, three more to recognize BTH, two to recognize TO, and four such circuits to recognize each call sign. It is proposed that each ship or unit have the capability to recognize thirty separate call signs. As mentioned above, only the circuits for the call signs need be changeable by the operators, the remainder being hard wired during manufacture.

At first thought having to have some 128 circuits such as Figure 11 seems like a great deal. However, such a circuit could easily be placed on a very small integrated circuit chip. Even using discrete components the total installation aboard a destroyer would be capable of being contained in a space no larger than that occupied today by two transmitter patch panels. If integrated circuits were used, the space required could be reduced by at least a factor of two.

B. HEADING RETRIEVAL

Figure 8 shows a record/playback system for message headings at the lower left. The purpose of this system is to retain the headings of each message on an easily retrievable recording mechanism. This is done so that if the message is addressed to own ship or unit, that portion of the heading prior to own unit call sign will be available. The system works as follows: The four contact double throw switch is in the NORMAL position. The output of the BTM recognizer circuit starts the recording process and the subsequent message heading is recorded. If an own unit address is sensed by the address recognizer, the output from the address recognizer shifts the recording mechanism to the play mode and the just recorded tape of the address is played through the converter to the heading tape perforator. The output of the address recognizer, operating through the switch, also causes the switch to throw over to the AUXILIARY position. This is done so that in case a second heading is received prior to the time that the NORMAL recorder has finished playing back the immediately previous one, a recorder will be available to accept it and record it. The switch in the AUXILIARY position operates very similarly to when it is in the NORMAL position. When the output of the address recognizer indicates that an own unit call sign has been received, the AUXILIARY recorder is set to play back the heading with the

heading tape perforator. This again, acting through the switch, causes the switch to throw back to the NORMAL position.

If an own unit address is not recognized, the output from the BTH recognizer circuit stops the heading recorder and resets it to be ready to start recording again when the next BTM is sensed.

This system is made necessary by the fact that two consecutive messages could possibly both be addressed to own ship or unit. Particularly this could cause a problem if both messages were of the type shown in Figure 13. In this case, a second heading would surely be received prior to the time that the portion of this message above own ship call sign could be printed out by the heading perforator.

The output of this system is copied on tape perforators for two reasons: 1. With the heading down to own unit call on one tape and the remainder of the message on another, it will be easy for the message center radiomen to take the two tapes and put them through a tape reader in the proper sequence to produce a page copy of the message in original and proper form. The page printer can be used to print either a page copy, a manifold message form, or a reproducing copy such as a Ditto mat. 2. Tape perforators are much less complicated mechanically than are page printers and therefore are easier to maintain. This arrangement minimizes the number of page printers required aboard a ship.

```
R 061247Z

FROM    CQZD
TO      WDFB
        CAQI
        NWER
        NHTN
        NGTR
        NBIP
        NCMW
        NTUG
        NIOE
        NGJK
        NSDL
        NXET
        NBHS <------ own ship call
        NKGW

BTH
UNCLAS
CANCEL MY 032150Z
BTM
```

Figure 13. Sample Message

V. SYSTEM CONSIDERATIONS

The system proposed above is a workable, basically simple system for only printing out in hard copy form aboard a destroyer, the messages specifically addressed to that ship or unit. It is intended first and foremost to reduce the workload on the communications personnel who man radio central. It has several other advantages which accrue. Perhaps most important of these is the reduction in wear and tear on the installed teletype equipment. While this equipment is exceedingly well designed and built, and has exhibited a high degree of reliability, it is still largely mechanical in nature and with constant operation, it requires constant attention. Only printing out the messages which are addressed to own ship on a page printer will reduce the operating time of these very complicated machines to a small fraction of what it is now.

The system provides a continuous list of numbers available aboard each ship in the form of the tape of the broadcast. This will comply with the requirement for a complete file of broadcast numbers. The system can be easily bypassed and the entire broadcast printed out as is now done in case of system failure or the requirement for hard copy of the whole broadcast.

More and better security is provided on the broadcast. With the universal use of on-line cryptographically covered

transmissions, much information is printed out in every ship's radio central which is definitely out of the "need to know" category for personnel observing it. This system would largely if not completely prevent this unnecessary viewing.

Time spent by radio central watch personnel, the radio central supervisor, and the ship's or unit's communications officer in checking, double checking, and triple checking the broadcast messages is all but eliminated.

This system is sure to run into criticism from some quarters on the basis of intelligence gathered from the fleet broadcast. It is not an unusual practice for senior commanders to expect that ships and junior commanders will gather intelligence concerning possible future operations, schedule changes and requirements from messages which appear on the broadcast and are not addressed to these units. This is taken as the mark of a "sharp" command by some. It is felt that the benefits accruing in terms of saved time, less equipment wear and tear, and improved security greatly outweigh this objection.

VI. CONCLUSION

In conclusion then, the system herein proposed is workable, is possible to build within the state-of-the-art, and is indeed possible to construct with off-the-shelf components. It is small in size, and being completely solid state, would have a very high mean time between failures and would therefore require little of the ship's force time or talent. Modularization of this system to allow easy repair is entirely feasible. It can be easily bypassed in case of failure. The system's address recognition capability is easily changed by the ship's force operating personnel, and requires very little training to be able to operate. It should be an important adjunct to fleet communications.

APPENDIX A

Teletype Receiver Type W706

(This material is taken from the 1967 edition of the Digital Logic Handbook, Flip Chip Modules, published by Digital Equipment Corporation of Maynard, Massachusetts.)

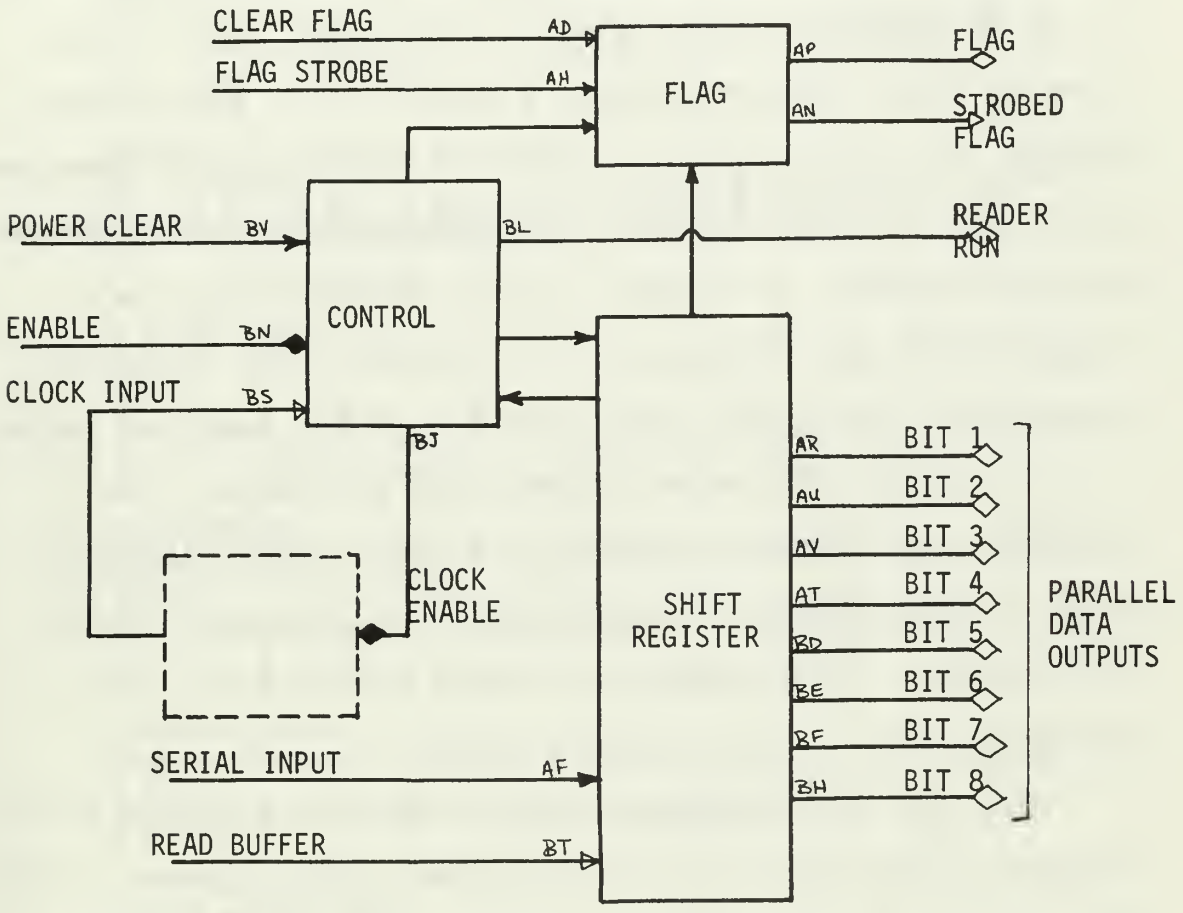


Figure 14. W706 Teletype Receiver

The W706 Teletype Receiver is an integrated circuit, serial-to-parallel Teletype code converter, self contained on a double-height module. This unit includes all of the serial to parallel conversion, buffering, gating, and synchronizing necessary to transfer information between an incoming asynchronous serial teletype line and a parallel binary

device. Either a five bit serial character consisting of 7.0, 7.5, or 8.0 units or an eight bit serial character of 10.0, 10.5, or 11.0 units can be assembled into parallel form by the W706 through the use of selective jumpers on the module. The serial input for one character is expected to be in sequence: a one unit -3 volt start signal, the five or eight character bits, a ground level stop signal of 1.0, 1.5, or 2.0 units. When the conversion is complete, the start and stop elements accompanying the serial character are removed. A logical 1 for a character bit is a ground level and a logical 0 is -3 volts. The first bit received on the serial line is Bit 1 at the parallel output.

To perform the serial to parallel conversion, the receiver continuously examines the serial input line, and when a start element is recognized, the receiver enables the external clock through the Clock Enable Output and synchronizes with the incoming signal.

When the last character bit, either bit 5 or bit 8, is received, the flag is set and a ground level appears at the Flag Output. At this time, the Parallel Data Outputs of the W706 can be examined by a Read Pulse, and if desired, the flag can be cleared by a pulse on the Clear Flag Input. A new serial character must not be put on the Serial Input until the stop time of the previous character is counted out and so indicated by a ground level on the Clock Enable Output. For additional timing information see Figure 15. The W706 may be connected to devices other than a teletype,

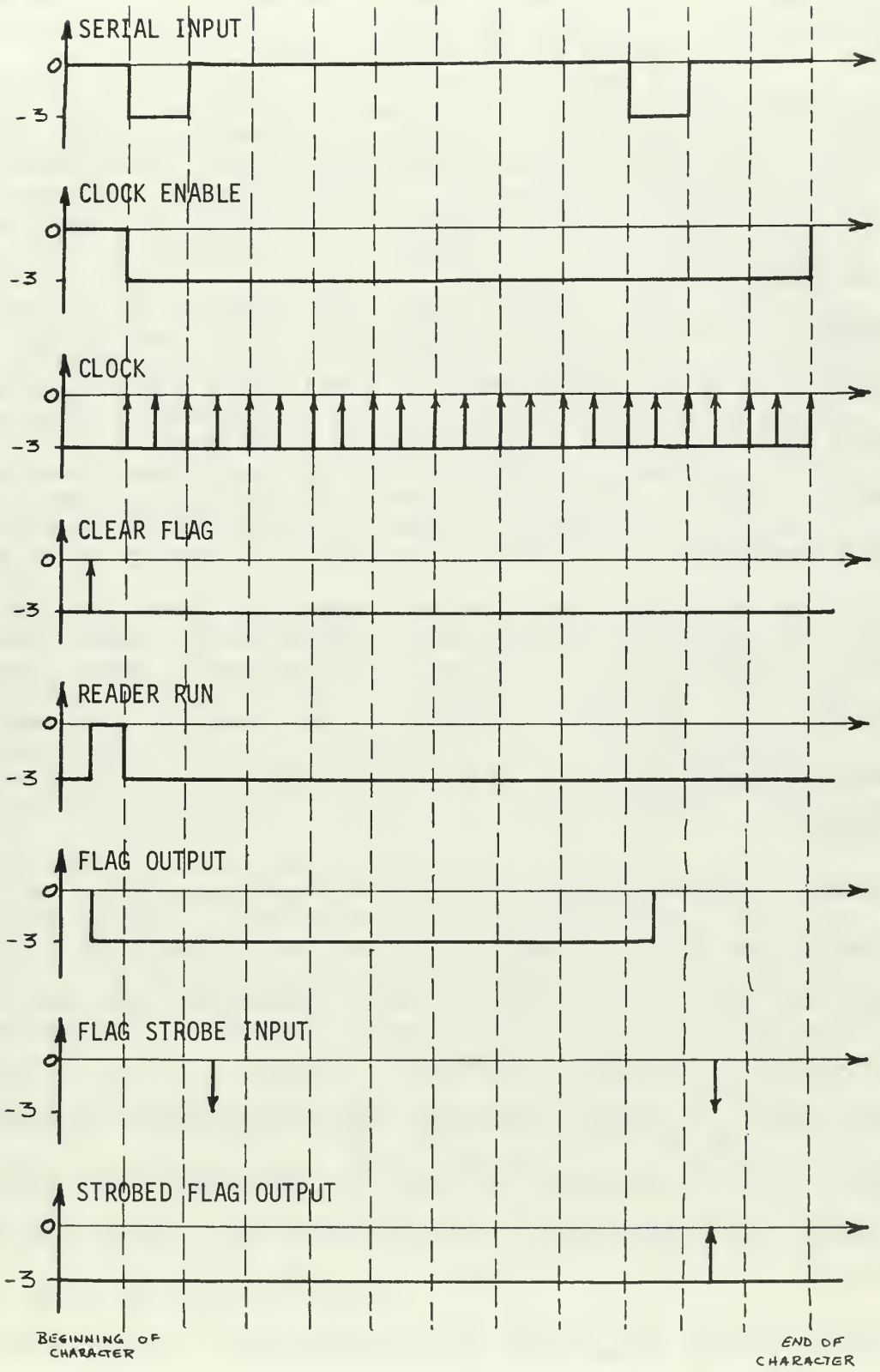


Figure 15. Typical Timing Diagram - Parallel Output. 8-Bit (01,111,111) -2 Unit Stop Time. Clamped Loads (W002 or W005) on Outputs

providing that their serial output is similar to a teletype code. Start element noise rejection of the W706 is approximately one volt from ground, requiring a line filter or use of the W708 on noisy teletype lines. To obtain additional Teletype applications data, write for Applications Note AP-W-1.

INPUTS: Standard digital levels of -3 volts and ground or 400 nsec pulses as generated by module types R602 and W103. Input pins are shown on the diagram in Figure 14.

CLOCK: 400 nsec positive pulses with a maximum receiver input frequency of 200 kHz. The clock frequency must be twice the required serial input frequency thus defining one unit of character time as two clock periods. Input loading is 2.8 ma at -3 volts. The clock used must be externally gateable and similar to R401 unless the W706 is used with a W708.

ENABLE: A diode input, which if brought to ground, will disable the clock through clock enable. Disabling (or enabling) the clock during a serial character can result in incorrect character reception.

CLEAR FLAG: A ground level or Digital standard 400 nsec positive pulse will clear the flag. If a level is used, it must be returned to -3 volts before the flag can be set. Loading is 1.4 ma at -3 volts. Typically the flag is sensed through one of the flag outputs and then cleared.

FLAG STROBE: Digital standard 400 nsec negative pulse or a -3 volt level. Loading is 1.4 ma at -3 volts. This

input is NANDed with the flag and provides a ground level Strobed Flag Output signal when the flag is set.

READ BUFFER: A 400 nsec positive pulse provides parallel information from the W706. During this pulse, any bit which is a logical 1 will generate a 400 nsec positive pulse at the corresponding bit output. This input can be held at ground for continuous monitoring of bit outputs. Typically, this pulse is generated after a Flag Output has been sensed so that no incorrect character will be received on the parallel lines. Loading is 2.8 ma at -3 volts.

POWER CLEAR: Same input signals and loading as for Flag Strobe. Initialization of module components by a Power Clear signal is not necessary if the first character received after power turn-on is insignificant. When not used, Power Clear can be left disconnected.

SERIAL INPUT: Digital standard levels of -3 volts and ground. A ground level during a bit input represents a logical 1. The first character bit to come in on this input appears as Bit 1 output. Loading is 2.8 ma at -3 volts.

OUTPUTS: All outputs are capable of supplying 20 ma at ground. The external load may be connected to any voltage between ground and -20 volts. Clamped loads such as W002 and W005 can also be used.

BITS 1 THRU 8: Buffered outputs generated by NANDing the internal bit and the Read Buffer. A ground level or positive pulse output represents a logical 1 for that bit. Unused outputs can be left open.

FLAG OUTPUT: Ground level output when the flag is set.

STROBED FLAG OUTPUT: Ground level output or pulse output when Flag Strobe is at -3 volts and the flag is set.

CLOCK ENABLE: Used with R401 clock or equivalent to synchronize the clock to incoming serial data. The output is an open circuit whenever a serial input is present and at ground at all other times. When used with a R401, this output is connected to the enable input of the R401.

READER RUN: Of use in teletypes equipped with relay controlled paper tape readers. The Reader Run Output is enabled (ground level) by a Clear Flag pulse and disabled by the W706 circuitry when a start pulse is received on the serial input. For additional information, see Figure 1.

JUMPERS: The W706 is shipped with all jumpers in position.

POWER: -15(B)/12 ma: +3.6 volts/400 ma. This power is available from a W705 or any commercial supply that has an output regulation of ±5%.

BIBLIOGRAPHY

1. Bartee, T. C., Digital Computer Fundamentals, 2d ed., McGraw-Hill, 1966.

2. Digital Equipment Corporation, Digital Logic Handbook, 1967.

3. Howeth, L. S., History of Communications-Electronics in the United States Navy, Government Printing Office, 1963.

4. Millman, J. and Taub, H., Pulse, Digital and Switching Waveforms, McGraw-Hill, 1965.

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13. ABSTRACT

An address recognition system is proposed for use on destroyers and other small ships. This proposed system is designed to be completely compatible with current fleet broadcast teletype communications methods and uses components, subsystems, and devices readily available off-the-shelf. The address recognition system is designed to search the fleet broadcast for messages addressed to own ship or unit. Only those messages addressed to own ship or embarked commands are printed out in the ship's communications center. A complete broadcast record is available if needed.

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
AUTOMATION						
COMMUNICATIONS						
FLEET BROADCAST						
TELETYPE EQUIPMENT						
ADDRESS RECOGNITION						